Annual Report 2011

Computing and Information Sciences

COLLEGE OF ENGINEERING

KANSAS STATE UNIVERSITY

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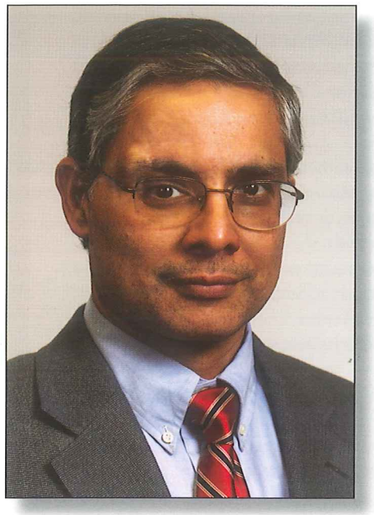
Message from the Department Head



It is with great pleasure that I share with you the 2011 annual research report for the department of computing and information sciences (CIS) at Kansas State University. The CIS department is continuing to make progress with strong support of our faculty excellence in research and teaching. Our graduate program continues to strengthen and students are in high demand, and we have strong interdisciplinary teaching and research programs.

I am pleased to announce that Dr. Patrice Chalin joined our department as an associate professor in fall 2011. Prior to this, Dr. Chalin was an associate professor at Concordia University. He works in the area of software engineering and high-assurance computing, and has previously collaborated with faculty in our department.

In 2011, Dr. John Hatcliff was appointed as a University Distinguished Professor, the highest honor given to a faculty member at Kansas State University. In addition to John Hatcliff, Dr. David Schmidt is also a University Distinguished Professor. The CIS department is honored to have two University Distinguished Professors (out of a total of three in the College of Engineering). Dr. Scott DeLoach was the recipient of the College of Engineering Frankenhoff Outstanding Research Award in 2011. This award is given annually to a faculty member who has demonstrated excellence in research and promotion of graduate programs in the past five years.

The research programs in our core areas continue to grow strongly. Faculty in the CIS department are extensively involved in multidisciplinary research supported by our high-performance computing infrastructure. In 2011, Dr. Dan Andresen received a major grant from the National Science Foundation Major Research Instrumentation program to substantially improve the high-performance computing infrastructure on campus. With additional support from Kansas State University, he will be developing the computing cluster as a university resource in the coming years. Our cybersecurity program has seen growth built on its previous successes. A group of faculty members in our department obtained a grant from the NSF Scholarship for Service Capacity Building program to develop cybersecurity curriculum for a broad cross-section of students. Another group of faculty members partnered with faculty from the electrical and computer engineering department to receive a large NSF Cyber-Physical System program grant to study multi-agent based control and security issues in power distribution systems. Finally, a team of CIS faculty worked with two companies, National Technical Systems and CABEM Technologies, and the K-State Institute for Commercialization to establish CyberSep, a consortium to explore development of cybersecurity services.

CIS faculty are actively involved in providing professional service to the computer science discipline. In addition to participating in the organization of national and international conferences, our faculty have organized several regional conferences and workshops. These include the Greater Kansas Cybersecurity Workshop, Mid-America Cybersecurity Conference and Workshop on Systems of Medical Devices.

This 2011 report cannot cover all of the CIS accomplishments for the year. Please visit the website http://www.cis.ksu.edu for a more complete picture.

Gurdip Singh
Department Head
Computing and Information Sciences
Kansas State University

FEATURE

High-performance computing at K-State

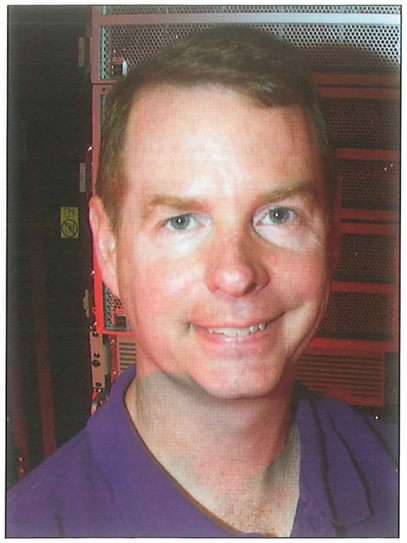
by Daniel Anderson and Jennifer Tidball

A group of Kansas State University scientists is boosting research across campus by making the largest supercomputer in the state even bigger. The project also will benefit researchers at other schools in Kansas.

The scientists, led by Daniel Andresen, associate professor of computing and information sciences, have recently received a three-year $700,000 grant from the National Science Foundation's Major Research Instrumentation Program to upgrade K-State's research computing cluster called Beocat. The scientists also received $300,000 in matching funds from the university.

Beocat is a cluster of servers that provides computational support for large research projects and is located in the university's computing and information sciences department in the College of Engineering. The cluster's design type is called Beowulf, so the designers called the university's form Beocat in honor of the K-State Wildcats.

Beocat supports research in four colleges and 12 to 15 departments across campus, and the upgrade will at least double its research capacities. While the average desktop or laptop has between two and four cores in its central processing unit, Beocat has 1,200 cores. It also has



10 machines, each with 64 gigabytes of memory, which is much more than the average two to four gigabytes that come with a desktop or laptop. The upgrade will give Beocat six individual machines with a terabyte of memory and more than 2,000 total cores.

"That's like 1,500 laptops stacked up, or 1,000 desktops stacked up and working together," Andresen said.

The extra memory will be especially helpful for some of the larger research projects across campus. For example, it takes about 50 gigabytes of space to analyze a single genome. A group of biologists on campus may want to analyze 5,000 genomes— a huge computing task that requires a lot of memory. But an upgraded Beocat will be able to handle such a large research load in a timely manner.

The number of Beocat users has been doubling every 12-18 months as student and faculty get excited about its potential. Beocat has about 450 users working on research in areas such as life sciences, genetics, chemistry and agriculture. Some of the supercomputer's projects have involved looking at the flowering time of plants, understanding how water policies and practice changes affect the Ogallala Aquifer in western Kansas, and collaborating with the University of Kansas and the University of Oklahoma to study the effects of carbon flux and species migration.

Additionally, the supercomputer's work fits in with the university's 2025 vision, Andresen said. Having better on-campus resources, such as an upgraded supercomputer, will help faculty members produce more accurate and cost-effective research.

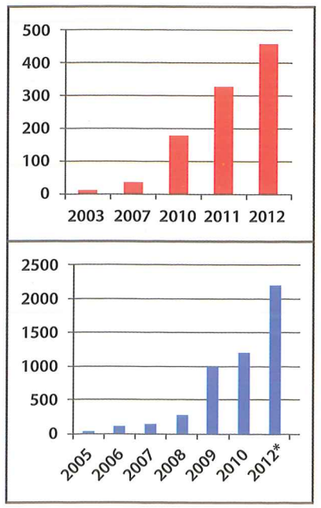


Figure 1
Beocat growth in cores (top) and uses (bottom)

"This type of capacity will drive lab experiments as well as provide simulations," Andresen said. "Research now involves theory, lab work and simulation, which is computer driven. This upgrade will help with simulation because you can model things first, that might be very expensive, before you actually apply them."

Not only does the supercomputer help scientists and researchers at Kansas State University, but researchers at colleges throughout the state of Kansas— including Emporia State University, Benedictine College and Bethany College— are also able to use the supercomputer.

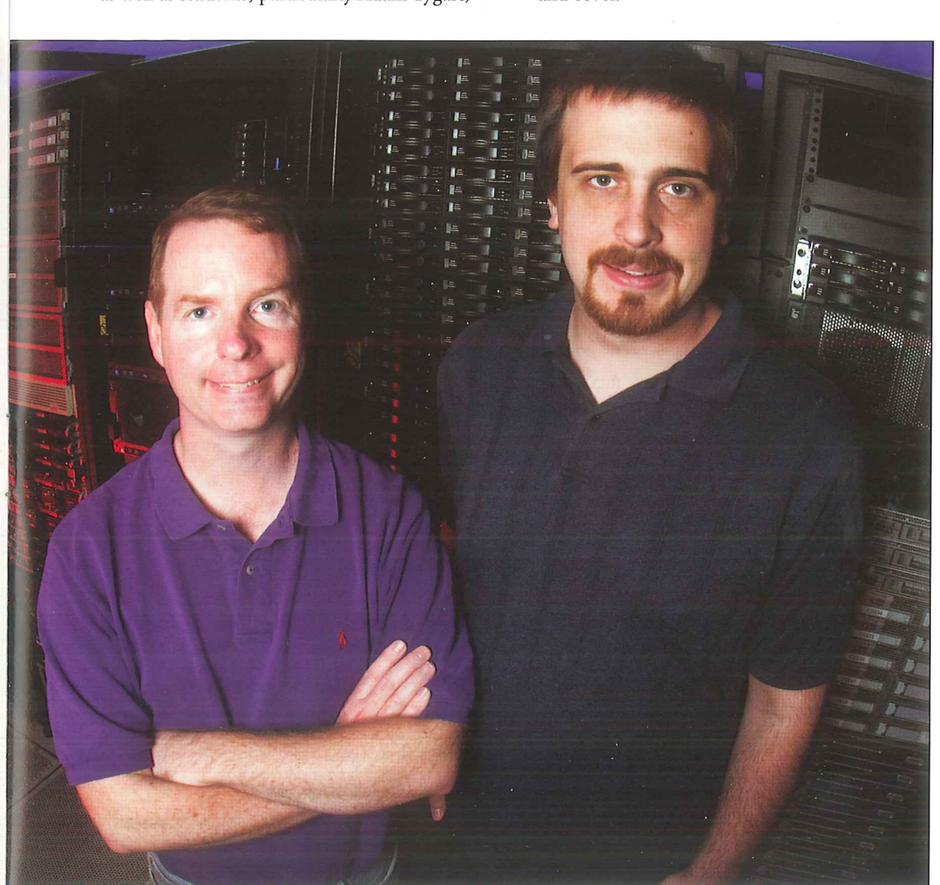
"This supercomputer allows faculty to have better access to getting research done with their research dollars," Andresen said. "It will also enable us to reach out and really have an impact on the community colleges and four-year institutions throughout the state. This will also help the Kansas work force because we are going to be graduating more people who actually know how to use these cutting-edge technologies."

The group has started installing the upgraded equipment. The upgrade will involve faculty as well as students, particularly Adam Tygart, sophomore in computer science, Manhattan, who manages Beocat.

Other co-principal investigators on the project include Doina Caragea, assistant professor of computing and information sciences; Brett Esry, university distinguished professor of physics; Walter Dodds, university distinguished professor of biology; and David Steward, professor of civil engineering. Senior personnel on the project include Jianhan Chen, assistant professor of biochemistry, and Christine Aikens, assistant professor of chemistry.

So what's next for research computing at K-State – big data! As Martin LaMonica noted, "In years past, the go-to tools for researchers were specific to their field, whether it was a telescope or a microscope. Increasingly, it's computers and big data sets."

The current grant will give researchers about 600TB of storage, but areas like genomics can generate 1TB of data per genome – and K-State is leading an effort to sequence 5,000 of them. The work simulating economic, sociological and ecological factors in southwest Kansas to help protect the Ogallala Aquifer uses the 25TB LIDAR dataset to calculate ground topology and cover.



Faculty

FACULTY

Gurdip Singh
Department Head and Professor
Ph.D., Computer Science, State University of New York at Stony Brook, 1991
M.S., Computer Science, State University of New York at Stony Brook, 1989
B.Tech, Computer Science and Engineering, Indian Institute of Technology, 1986
Research: Distributed algorithms, middleware services, sensor networks, optimization, modular design.
Teaching: Distributed computing, network protocols, operating systems, embedded systems.

Torben Amtoft
Associate Professor
Ph.D., Computer Science, University of Aarhus, 1993
M.Sc., Computer Science, University of Copenhagen, 1989
B.Sc., Mathematics and Computer Science, University of Copenhagen, 1985
Research: Program analysis, language-based security, program slicing, information-flow analysis, dependency analysis.
Teaching: Databases, algorithms, logic and verification, formal language theory, programming languages.

Daniel Andresen
Associate Professor
Ph.D., Computer Science, University of California, Santa Barbara, 1997
M.S., Computer Science, California Polytechnic State University, SLO, 1992
B.S., Computer Science and Mathematics, Westmont College, 1990
Research: Parallel and distributed computing, scheduling and run-time systems, high-performance scientific computing, distributed-sensor networks, telemedicine.
Teaching: Operating systems, distributed systems, computer architecture, WWW technology.

Doina Caragea
Assistant Professor
Postdoctoral, Computer Science, Iowa State University, 2004-2006
Ph.D., Computer Science, Iowa State University, 2004
M.S., Computer Science, University of Bucharest, Romania, 1997
B.S., Computer Science, University of Bucharest, Romania, 1996
Research and teaching: Bioinformatics, artificial intelligence, machine learning, data mining and knowledge discovery, visual data mining, ontologies and information integration, information retrieval and semantic web.

Patrice Chalin
Associate Professor
Ph.D., Computer Science, Concordia University, 1995
M.S., Computer Science, Concordia University, 1989
B.S., Computer Science, Concordia University, 1988
Research: Program synthesis and software verification, medical device integration, coordination and interoperability, software engineering, web-based enterprise applications.
Teaching: Software specification, semantics of programming languages.

Scott A. DeLoach
Professor
Ph.D., Computer Engineering, Air Force Institute of Technology, 1996
M.S., Computer Engineering, Air Force Institute of Technology, 1987
B.S., Computer Engineering, Iowa State University, 1982
Research: Applying software engineering methods, techniques, and models to design and development of intelligent, complex, adaptive, and autonomous multiagent systems; building tools and techniques necessary to design and build cooperative robotic systems; building and developing hybrid intelligent systems that include humans, software agents, and mobile hardware agents.
Teaching: Agent-oriented software engineering, software engineering, software management.

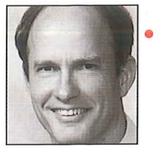
David A. Gustafson
Professor
Ph.D., Computer Science, University of Wisconsin, 1979
M.S., Computer Science, University of Wisconsin, 1973
B.S., Meteorology, University of Utah, 1969
B.S., Mathematics, University of Minnesota, 1967
Research and teaching: Software engineering, software metrics, software testing, design analysis, robotics, vision, face recognition, emotion recognition, biometrics, healthcare applications of robots.

John Hatcliff
Professor
Ph.D., Computer Science, Kansas State University, 1994
M.Sc., Computer Science, Queen's University, Kingston, Ontario, Canada, 1991
B.A., Computer Science/Mathematics, Mount Vernon Nazarene College, 1988
Research: Formal methods in software engineering, software verification, security analysis and certification, model checking, static analyses of programs, concurrent and distributed systems, middleware, model-integrated computing, semantics of programming languages, compiler construction, logics and type theory.
Teaching: Foundations of programming languages, software specification and verification, logic and set theory, construction of concurrent systems, compiler construction, formal language theory, software engineering, functional programming, logic programming.

Rodney Howell
Associate Professor
Ph.D., Computer Science, The University of Texas at Austin, 1988
B.S., Computer Science, Wichita State University, 1984
Research: Real-time scheduling, algorithm analysis, self-stabilizing systems.
Teaching: Analysis of algorithms, data structures, formal language theory, symbolic logic, real-time scheduling theory.

William Hsu
Associate Professor
Ph.D., Computer Science, University of Illinois at Urbana-Champaign, 1998
M.S., Computer Science, Johns Hopkins University, 1993
B.S., Computer Science and Mathematical Sciences, Johns Hopkins University, 1993
Research: Laboratory for Knowledge Discovery in Databases (KDD)—research group emphasizing machine learning and intelligent systems.

Masaaki Mizuno
Professor
Ph.D., Computer Science, Iowa State University, 1987
M.S., Computer Science, Pennsylvania State University, 1982
M.S., Electrical Engineering, Keio University, Japan, 1980
B.S., Electrical Engineering, Keio University, Japan, 1978
Research and teaching: Operating systems, distributed systems, real-time embedded systems, object-oriented systems.



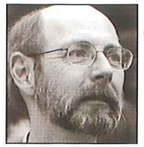
Mitchell Neilsen
Associate Professor
Ph.D., Kansas State University, Computer Science, 1992
M.S., Kansas State University, Computer Science, 1989
M.S., Kansas State University, Mathematics, 1987
B.S., University of Nebraska-Kearney, Mathematics, 1982
Research: Distributed computing systems, real-time embedded systems, computational engineering, natural resources.
Teaching: Computer architecture, operating systems, networking, real-time systems.

Faculty

FACULTY

Xinming (Simon) Ou
Assistant Professor
Ph.D., Computer Science, Princeton University, 2005
M.E., Computer Science, Tsinghua University, 2000
B.E., Computer Science, Tsinghua University, 1998
Research and teaching: Computer security, enterprise network defense, intrusion detection and analysis, security metrics, programming languages, high-assurance systems.

Robby
Associate Professor
Ph.D., Computer Science, Kansas State University, 2004
M.S., Computer Science, Kansas State University, 2000
B.S., Computer Science, Oklahoma State University, 2000
Research: Software verification, specification, analysis, transformation, specialization, testing, software engineering, model-driven software development.
Teaching: Specification and verification of software, programming languages, compiler design and implementation.



David A. Schmidt
Professor
Ph.D., Computer Science, Kansas State University, 1981
M.S., Computer Science, Kansas State University, 1977
B.A., Mathematics, Fort Hays State University, 1975
Research: Abstract interpretation, static program analysis, denotational semantics.
Teaching: Programming methodology, program validation, software architecture.

Eugene Vasserman
Assistant Professor
Ph.D., Computer Science, University of Minnesota, 2010
M.S., Computer Science, University of Minnesota, 2008
B.S., Biochemistry, Neuroscience, University of Minnesota, 2003
Research: Distributed system security, privacy and anonymity, peer-to-peer systems, network security, medical and embedded device security, applied cryptography usable security.
Teaching: Secure networks and distributed systems.

Beth Unger
B.S., Mechanical Engineering, Michigan State University, 1961
M.S., Mathematics, Michigan State University, 1963
Ph.D., Computer Science, The University of Kansas, 1978
Research: Database and knowledge system design, data security, information techonology for learning, university of the future
Teaching: Databases, data security.

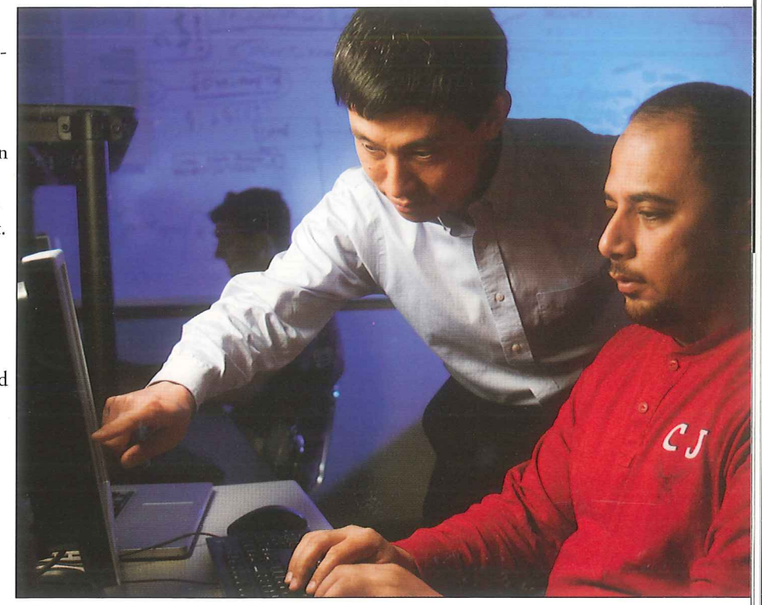
Virgil Wallentine
Professor
Ph.D., Computer Science, Iowa State University, 1972
M.S., Computer Science, Iowa State University, 1970
B.S., Mathematics, Iowa State University, 1965
Research: Parallel scientific simulations, verification of concurrent software, health IT systems.
Teaching: Parallel and distributed systems, impact of computing on society.

Research

RESEARCH

Argus Group—Cyber Security Research
http://people.cis.ksu.edu/~xou/argus/
CISA—Center for Information and Systems Assurance
http://www.cisa.ksu.edu

The Argus group carries out cyber security research under the direction of Dr. Simon Ou. Argus' focus is on the defense aspect of cyber warfare, and our philosophy is that successful cyber defense can only be achieved through automated coordination of various observation and action points in an enterprise environment. Traditional solutions like firewalls and IDS systems are limited in effectiveness, since they only look at one aspect of the system and lack the capability of "connecting the dots" among various information sources to gain a global picture of a system's security status. Our research aims at providing enabling technologies for such automated correlation and analysis with solid theoretical foundation and empirical study.



Argus is part of the Center for Information and Systems Assurance (CISA) at Kansas State University, an umbrella organization established in 2009 for all cybersecurity and information assurance research in the university. Faculty at CISA conduct research in computer and network security, high-assurance software systems, language-based security, security in health IT systems and security in distributed sensor systems. CISA has extensive collaboration with a number of external industry and government partners such as Rockwell Collins, HP Labs, DRDC-Ottawa, National Institute of Standards and Technology, Idaho National Laboratory, IAI Inc. and Telcordia Technologies. Research in CISA is funded by the National Science Foundation, Department of Defense and a number of industry partners.

Machine Learning and Bioinformatics (MLB) Group
http://people.cis.ksu.edu/~dcaragea/mlb

The MLB group aims to design algorithms and develop tools for analyzing large amounts of data, in particular, molecular sequence and gene-expression data. Main projects focus on the following:

- ontology engineering and classifier learning from semantically heterogeneous data sources
- EST data analysis, alternative splicing discovery and gene prediction
- gene regulatory network discovery from gene-expression data and sequence information

The MLB group is collaborating with the artificial intelligence and machine learning group at Iowa State University to produce an open-source system for knowledge acquisition and information integration from semantically heterogeneous data sources (NSF funding), and with the Bioinformatics Center at Kansas State University to produce bioinformatics and genomics tools (funding from K-State EcoGen and Targeted Excellence Program).

Collaborative Work on Computational Engineering – M. Neilsen
www.damsafety.info

The U.S. Department of Agriculture (USDA) and U.S. Army Corps of Engineers (USACE) are partnering with Kansas State University to incorporate research and field experience into computational tools for use in design and analysis of water-control structures. These tools provide the basis for optimal use of natural materials such as vegetation to protect embankments and spillways. Tools developed or under development through this cooperative work were highlighted in a booth at the Association of State Dam Safety Officials' (ASDSO) Annual Conference in 2009. Current work involves developing tools to analyze breach

failures and tools to perform risk assessment across the United States. Other computational engineering research uses finite-element analysis (FEA) to develop a turbo, solder interconnect preditor (Sandia TurboSIP) tool to evaluate Pb-free solder joints in electronic control packaging for satellite systems, etc.

Distributed Systems Lab

http://www.cis.ksu.edu/beocat

The distributed systems lab supports a wide range of interdisciplinary research around a core interest in efficient, effective distributed systems. Key projects include the K-State research computing cluster, BeoCat, the largest academic cluster in Kansas with 1,000 cores; enhancing the efficiency of SOAP/XML communications; medical informatics; ecological modeling; and veterinary telemedicine. Our work is frequently cross-disciplinary and common collaborators go beyond engineering, ranging from agricultural economics to veterinary medicine. Since 1998, the distributed systems lab has received funding from agencies such as the National Science Foundation, U.S. Food and Drug Administration, U.S. Department of Agriculture and NSF EPSCoR.

KDD Lab

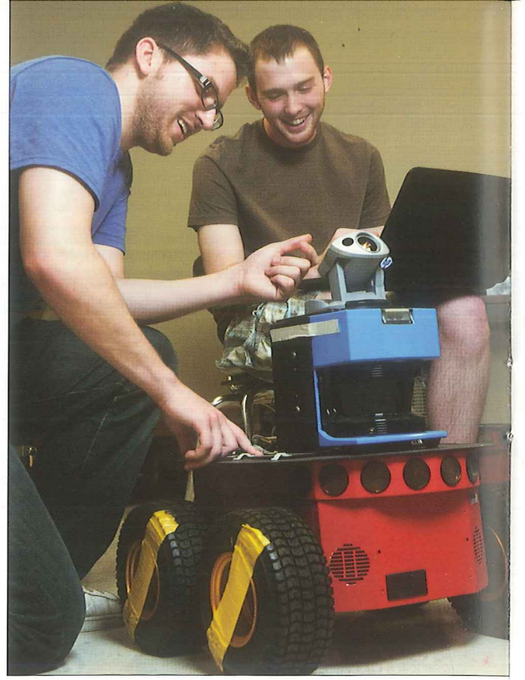
http://www.kdd.cis.ksu.edu

The laboratory for knowledge discovery in databases (KDD lab) aims at developing technologies for building models of events and processes from data, and then using these models to help make decisions. Research in the KDD lab focuses on developing algorithms and techniques for the following:

- data mining, machine learning, and probabilistic reasoning over large data sets and text collections
- human language technologies: computational linguistics and information extraction
- visualizing, learning, and reasoning about events and event streams
- analysis of spacial data: georeferencing, spatial outlier detection, deduplication, etc.
- modeling cognitive processes to better understand how humans reason about causality, especially with spacial and temporal data

Application of these algorithms include software tools for bioinformatics, epidemiology, health informatics, computational physics, sensor network optimization and computer security.

Tools developed by the lab have been used by the Department of Defense, Office of Naval Research (ONR), Army Research Lab (ARL), National Agricultural Biosecurity Center (NABC) and Kansas Department of Transportation (KDOT). Federal and corporate sponsors of the KDD lab since 1999 include the NSF, DHS, ONR, ARL, Raytheon and American Diagnostic Medicine.



The KDD lab maintains a research collaboration with the University of Illinois at Urbana-Champaign, including the National Center for Supercomputing Applications (NCSA).

Application areas currently being pursued in the laboratory for knowledge discovery in databases include user modeling, adaptation and personalization; game-theoretic approaches to information security and tamper-resistant sensor networks; geoinformatics, bioinformatics and medical informatics; information extraction for question answering; information trust; and opinion mining, sentiment analysis and subjectivity analysis.

MACR Laboratory

http://macr.cis.ksu.edu

The multiagent and cooperative robotics (MACR) laboratory focuses on applying software engineering methods, techniques, and models to the design and development of intelligent, complex, adaptive and autonomous multiagent systems.

Current research focuses on building the tools and techniques necessary to design and build cooperative robotic systems, where the robots work autonomously but cooperate as part of a team. This research also includes building and developing hybrid intelligent systems that include humans, software agents and mobile hardware agents. Key elements of this work are—

- a set of methods and techniques for analyzing and designing complex, adaptive systems;
- a set of organization-based models upon which the system analysis, design and implementation are based;
- a set of generic technologies that implement organization-based models; and
- a set of multiagent and cooperative robotic systems used to demonstrate our approaches.

The lab has produced the organization-based multiagent systems engineering methodology (OMaSE) and its associated agentTool development environment. The MACR lab is collaborating with the human-machine teaming laboratory at Vanderbilt University to integrate humans as teammates into cooperative robotics teams. Since 2002, the MACR lab has received more than $3.8 million in funding from the National Science Foundation, the Air Force Office of Scientific Research, United States Marine Corps, M2 Technologies and Stanfield Systems Inc.

SAnToS Laboratory

http://santos.cis.ksu.edu

The laboratory for specification, analysis and transformation of software (SanToS) aims to develop technologies and tools for effective construction of high-confidence software systems. Work in the lab emphasizes—

- use of rigorous analysis techniques with solid mathematical underpinnings,
- a variety of forms of code and model-integrated software specifications to capture crucial system correctness properties, and
- use of software models as a key mechanism for capturing essential software structure leading to system analysis and verification.

The lab has produced tools including the Bandera and Bogor software model checking frameworks, the Cadena modeling frameworks for component-based systems, and the Indus static and analysis and slicing frameworks that are widely recognized within the academic software engineering and verification communities. SAnToS researchers are currently focusing on applications in security, software product lines, integrated medical devices and sensor networks. Since 1998, SAnToS Laboratory has received more than $8.5 million in funding through agencies and companies such as the National Science Foundation, Army Research Office, Air Force Office of Scientific Research, Defense Department Advanced Projects Agency (DARPA), NASA, Lockheed Martin, Rockwell Collins, IBM, Honeywell and Intel.

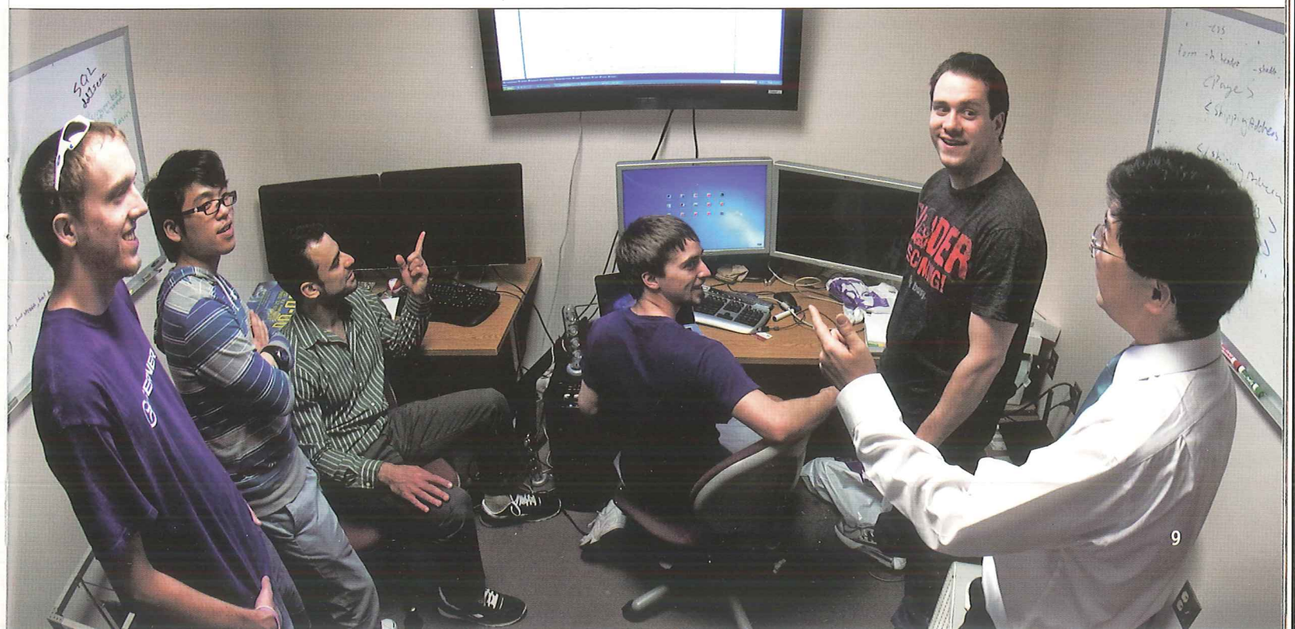
The Sensor Networks Laboratory

http://persnl.cis.ksu.edu

The sensor networks laboratory is conducting research to develop tools and methodologies for development of sensor applications, and supports multidisciplinary research that draws on faculty expertise from several disciplines. The lab has the following goals:

- develop model-driven tools for designing and deploying large-scale sensor networks
- provide the infrastructure support necessary to enable K-State researchers to perform multidisciplinary research and address challenges posed by the next generation of sensor systems
- provide laboratory support in various courses to educate and train students for networking and distributed computing research

The lab is currently supported by the K-State's Targeted Excellence Program to promote multidisciplinary research. With additional instrumentation support grants from NSF and DoD, an experimentation test bed has been established to rapidly prototype large-scale sensor applications and to evaluate developed technologies. Multidisciplinary projects in the areas of veterinary telemedicine, hydrology, grain science, agronomy, agricultural engineering and environmental monitoring are being pursued in collaboration with researchers from several departments in engineering, veterinary medicine, agronomy and agriculture.



PUBLICATIONS

Andresen

- **Andresen, D.**: "Beocat: Providing Computational Support for the K-State Research Community." Poster session, Oklahoma Supercomputing Symposium, Norman, OK, October 11-12, 2011.
- **Andresen, D.**, Dodds, W., Krishtalka, L., Luo, Y., McMullen, D., Palmer, M., Xiao, X., and Yuan, M.: "The CyberCommons: Cyberinfrastructure for Understanding and Forecasting Ecological Change in the Central Plains Grasslands." Poster session, Oklahoma Supercomputing Symposium, Norman, OK, October 11-12, 2011.
- **Andresen, D.**: "Beocat: Providing Computational Support for the K-State Research Community." Poster session, Cybercommons Annual Symposuim, Norman, OK, September 30, 2011.
- Sharp, J., Vasserman, E., **Andresen, D.**, and Hatcliff, J.: "Towards an ICE-Compliant Logger within MDCF." In Proceedings of the Workshop on Infrastructure, Tools, and Technologies for Systems of Systems of Medical Devices (SoSMD), Lawrence, KS, November 12, 2011.
- Bulatewicz, T. and **Andresen, D.**: "Efficient Data Access for Open Modeling Interface (OpenMI) Components." Proceedings of the 2011 International Conference on Parallel and Distributed Processing Techniques and Applications (PDPTA'11), Distributed Processing Techniques and Applications (PDPTA'11), Las Vegas, NV, July 18-21, 2011.
- Mehlinger, T., **Andresen, D.**, and Tygart, A.: "Towards Simplifying Work on Execution on the Grid." Proceedings of the 7th Int'l Conference on Grid Computing and Applications (GCA'11), Las Vegas, NV, July 18-21, 2011.
- Staggenborg, S. A., Waite, J., Aistrup, J., **Andresen, D.**, Bernard, E. A., Bulatewicz, T., Kulcsar, L. J., Peterson, J. M., Schlegel, A., Steward, D. R., and Welch, S. M.: "Simulating Decit Irrigation for Use in Coupled Model Scenarios." Welch, S. M. ed. Proceedings of the 41st Biological Systems Simulation Conference. pp. 37-38, Austin, TX, April 19-21, 2011.
- Steward, D. R., Aistrup, J., **Andresen, D.**, Bernard, E. A., Bulatewicz, T., Kulcsar, L. J., Peterson, J. M., Staggenborg, S. A., and Welch, S. M.: "A Comprehensive Crop Modeling Geohydrolic Framework to Study the Consequences of Management Practices." Welch, S. M. ed. Proceedings of the 41st Biological Systems Simulation Conference, pp. 20-21, Austin, TX, April 19-21, 2011.
- Bulatewicz, T. and **Andresen, D.**: "Efficient Data Access for Open Modeling Interface (OpenMI) Components." Welch, S. M. ed. Proceedings of the 41st Biological Systems Simulation Conference, pp. 18-19, Austin, TX, April 19-21, 2011.

Caragea

- Carolan, J.C., **Caragea, D.**, Reardon, K.T., Mutti, N.S., Pappan, K., Dittmer, N, Cui, F., Reeck, G.R, Castaneto, M., Poulain, J., Dossat, C., Wilkinson, T.L., Tagu, D., Reese, J.C., and Edwards, O.R.: "Predicted Effector Molecules in the Salivary Secretome of the Pea Aphid (Acyrthosiphon pisum) a Dual Transcriptomic/Proteomic Approach." Journal of Proteome Research, 2011 April 1;10(4):1505-18.
- Parimi, R. and **Caragea, D.**: "Predicting Friendship Links in Social Networks Using a Topic Modeling Approach." The 15th Pacific-Asia Conference on Knowledge Discovery and Data Mining (PAKDD), 2011.
- Caragea, C., Silvescu, A., Kataria, S., **Caragea, D.**, and Mitra, P: "Classifying Scientific Publications Using Abstract Features." In Proceedings of the Ninth Symposium on Abstraction, Reformulation and Approximation (SARA 2011), Parador de Cardona, Catalonia, Spain, 2011.
- Tangirala, K. and **Caragea, D.**: "Semi-Supervised Learning of Alternative Splicing Events Using Co-Training." In Proceedings of the IEEE International Conference on Bioinformatics and Biomedicine (BIBM'11), Atlanta, GA.
- Zhang, S., **Caragea, D.**, and Ou, X.: "An Empirical Study of Using the National Vulnerability Database to Predict Software Vulnerabilities." Proceedings of the 22nd International Conference on Database and Expert Systems Applications (DEXA 2011), Toulouse, France, 2011.
- Bahirwani, V. and **Caragea, D.**: "Study on Regulatory Motifs in Arabidopsis thaliana." Proceedings of the 2nd ACM Conference on Bioinformatics and Computational Biology (ACM-BCB'11), Poster program. Chicago, IL, 2011.
- Carolan, J.C., **Caragea, D.**, Reese, J.C., Reeck, G.R., Mutti, N.S., Tagu, D., Edwards, O.R., and Wilkinson, T.L.: "An Insight into the Salivary Secretome of the Pea Aphid (Acyrthosiphon pisum). Sixth International Symposium on Molecular Insect Science, Amsterdam, The Netherlands. October 2-5, 2011.

Chalin

- Sinnig, D., Khendek, F., and **Chalin, P.**: "Partial Order Semantics for Use Case and Task Models." Formal Aspects of Computing Journal, 23(3):307-332, 2011.
- Barrett, S., **Chalin, P.**, and Butler, G.: "Table-Driven Detection and Resolution of Operation-Based Merge Conflicts in Mirador." Proceedings of the European Conference on Modelling Foundations and Applications (ECMFA), Birmingham, UK, vol. 6698 of LNCS, pp. 329-344, 2011.
- Belt, J., Hatcliff, J., Robby, **Chalin, P.**, Hardin, D., and Deng, X.: "Bakar Kiasan: Flexible Contract Checking for Critical Systems Using Symbolic Execution." Proceedings of the NASA Formal Methods Symposium, LNCS 6617, pp. 58-72, 2011.
- Belt, J., Hatcliff, J., Robby, **Chalin, P.**, Hardin, D., and Deng, X.: "Enhancing Spark's Contract Checking Facilities Using Symbolic Execution." Proceedings of the International Conference on Ada and Related Technologies (SIGAda), ACM, New York, NY, USA, pp. 47-60, November 2011.
- Sinnig, D., **Chalin, P.**, and Khendek, F.: "Use Case and Task Models: An Integrated Development Methodology and Its Formal Foundation." DSRG Technical Report, Concordia University, 2011.
- Segal, L. and **Chalin, P.**: "A Comparison of Intermediate Verification Languages: Boogie and Sireum/Pilar." DSRG Technical Report, Concordia University, 2011.
- Belt, J., Robby, **Chalin, P.**, Hatcliff, J., and Deng, X.: "Efficient Symbolic Execution of Programs for Critical Systems." Technical Report SAnToS-TR2011-01-10, Kansas State University, 2011.

DeLoach

- Zhong, C. and **DeLoach, S.**: "Run-Time Models for Automatic Reorganization of Multi-Robot Systems." 6th International Symposium on Software Engineering for Adaptive and Self-Managing Systems (SEAMS 2011). Waikiki, Honolulu, Hawaii, May 23-24, 2011.
- **DeLoach, S.** and Ou, X.: "A Value-Based Goal Model." Multiagent & Cooperative Reasoning Laboratory Technical Report No. MACR-TR-2011-01. Kansas State University, May 2011.

Gustafson

- **Gustafson, D.**: "Neural Nets." McGraw-Hill Encyclopedia of Science and Technology, 2011.
- **Gustafson, D.**: "Software Engineering." Schaum Outline Series, 2002, Selected for McGrawHill ELibrary 2011.
- Chavez, A. and **Gustafson, D.**: "Color-Based Extensions to MSERs." ISVC11, Las Vegas, September 2011.

Hatcliff

- **Hatcliff, J.**, Vasserman, E., Weininger, S., and Goldman, J.: "An Overview of Regulatory and Trust Issues for the Integrated Clinical Environment." Proceedings of 3rd Joint Workshop on High Confidence Medical Devices, Software, and Systems, April 2011.
- Sharp, J., Vasserman, E., Andresen, D., and **Hatcliff, J.**: "Towards an ICE-Compliant Logger within MDCF." In Proceedings of the Workshop on Infrastructure, Tools, and Technologies for Systems of Systems of Medical Devices (SoSMD), Lawrence, KS, November 12, 2011.
- Belt, J., **Hatcliff, J.**, Robby, Chalin, P., Hardin, D., and Deng, X.: "Bakar Kiasan: Flexible Contract Checking for Critical Systems Using Symbolic Execution." Proceedings of the NASA Formal Methods Symposium, LNCS 6617, pp. 58-72, 2011.
- Belt, J., **Hatcliff, J.**, Robby, Chalin, P., Hardin, D., and Deng, X.: "Enhancing Spark's Contract Checking Facilities Using Symbolic Execution." Proceedings of the International Conference on Ada and Related Technologies (SIGAda), ACM, New York, NY, USA, pp. 47-60, November 2011.

Hsu

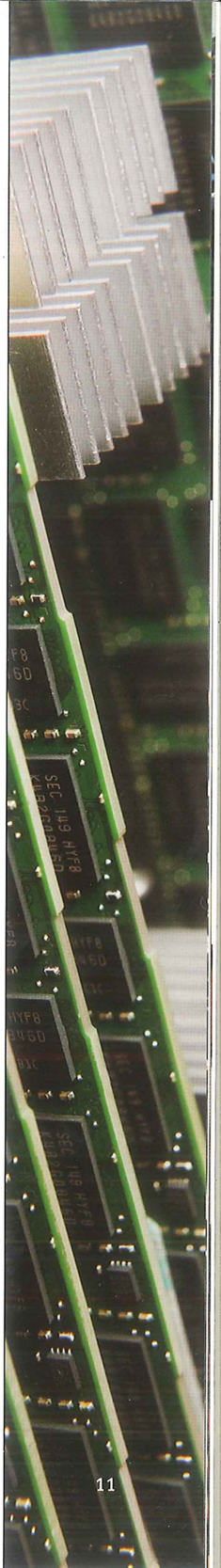
- **Hsu, W. H.**, Kallumadi, S., and Han, J., eds. (2011) Working notes of Workshop W-16, International Joint Conference on Artificial Intelligence: Heterogeneous Information Network Analysis (HINA 2011).
- Roy Chowdhury, S., Scoglio, C., and **Hsu, W. H.**: "Mitigation Strategies for Foot and Mouth Disease: A Learning-Based Approach." International Journal of Artificial Life Research, 2(2), 42-76, 2011.

Neilsen

- **Neilsen, M.L.**: "Model Checking Task Sets with Preemption Thresholds." Proceedings of the 16th International Conference on Parallel and Distributed Processing Techniques and Applications (PDPTA'10), Paper No. PDP4007, July 2011.
- **Neilsen, M.L.**, Temple, D.M., and Hanson, G.J.: "WinDAM: Earthen Embankment Erosion Analysis." Proceedings of the 24th International Conference on Computers and Their Applications in Industry and Engineering (CAINE-2011), Paper No. 90, November 16-18, 2011.
- Temple, D., **Neilsen, M.L.**, and Lobrecht, M., et.al: "SITES 2005.1.6 – Water Resource Site Analysis Computer Program – User Guide." Version 2005.1.6, 2011.

Ou

- **Ou, X.** and Singhal, A.: "Quantitative Security Risk Assessment of Enterprise Networks." SpringerBrief Series, Information Security, November 2011.
- Huang, H., Zhang, S., **Ou, X.**, Prakash, A., and Sakallah, K.: "Distilling Critical Attack Graph Surface Iteratively Through Minimum-Cost SAT Solving." 27th Annual Computer Security Applications Conference (ACSAC), December 2011. (Acceptance rate: 20%. Best Student Paper Award)
- Zomlot, L., Sundaramurthy, S., Luo, K., **Ou, X.**, and Rajagopalan, S.: "Prioritizing Intrusion Analysis Using Dempster-Shafer Theory." 4TH ACMWorkshop on Artificial Intelligence and Security (AISec), Chicago, USA, October 2011.
- Singhal, A. and **Ou, X.**: "Security Risk Analysis of Enterprise Networks Using Probabilistic Attack Graphs." NIST Interagency Report 7788, August 2011.
- Zhang, S., Caragea, D., and **Ou, X.**: "An Empirical Study of Using the National Vulnerability Database to Predict Software Vulnerabilities." Proceedings of the 22nd International Conference on Database and Expert Systems Applications (DEXA 2011), Toulouse, France, August 2011.
- Sundaramurthy, S., Zomlot, L., and **Ou, X.**: "Practical IDS Alert Correlation in the Face of Dynamic Threats." The 2011 International Conference on Security and Management (SAM),Las Vegas, USA, July 2011. (Acceptance rate: 23%)
- Zhang, S., **Ou, X.**, Singhal, A., and Homer, J.: "An Empirical Study of a Vulnerability Metric Aggregation Method." The 2011 International Conference on Security and Management (SAM'11), special track on Mission Assurance and Critical Infrastructure Protection (STMACIP'11), Las Vegas, USA, July 2011. (Acceptance rate: 23%)
- Zhang, S., **Ou, X.**, and Homer, J.: "Effective Network Vulnerability Assessment Through Model Abstraction." The Eighth Conference on Detection of Intrusions and Malware & Vulnerability Assessment (DIMVA), Amsterdam, The Netherlands, July 2011. (Acceptance rate: 32%)



Publications

Robby

- Belt, J., Hatcliff, J., **Robby**, Chalin, P., Hardin, D., and Deng, X.: "Bakar Kiasan: Flexible Contract Checking for Critical Systems Using Symbolic Execution." Proceedings of the NASA Formal Methods Symposium, LNCS 6617, pp. 58-72, 2011.
- Belt, J., Hatcliff, J., **Robby**, Chalin, P., Hardin, D., and Deng, X.: "Enhancing Spark's Contract Checking Facilities Using Symbolic Execution." Proceedings of the International Conference on Ada and Related Technologies (SIGAda), ACM, New York, NY, USA, pp. 47-60, November 2011.

Schmidt

- Jhala, R. and **Schmidt, D.A.**, editors. Proc. 12th International Conference on Verification, Model Checking, and Abstract Interpretation, Austin, TX, Lecture Notes in Computer Science 6538, Springer-Verlag, 2011.
- Doh, K.-G., Kim, H., and **Schmidt, D.A.** Abstract LR-Parsing. In Formal Modeling: Actors; Open Systems, Biological Systems: Festschrift for Carolyn Talcott. Springer LNCS 7000, 2011, pp. 90-109.

Vasserman

- Sharp, J., **Vasserman, E.**, Andresen, D., and Hatcliff, J.: "Towards an ICE-Compliant Logger within MDCF." In Proceedings of the Workshop on Infrastructure, Tools, and Technologies for Systems of Systems of Medical Devices (SoSMD), Lawrence, KS, November 12, 2011.
- Hatcliff, J., **Vasserman, E.**, Weininger, S., and Goldman, J.: "An Overview of Regulatory and Trust Issues for the Integrated Clinical Environment." Proceedings of 3rd Joint Workshop On High Confidence Medical Devices, Software, and Systems, April 2011.
- Schuchard, M., **Vasserman, E.**, Mohaisen, A., Foo Kune, D., Hopper, N., and Kim, Y.: "Losing Control of the Internet: Using the Data Plane to Attack the Control Plane." Proceedings of the Network and Distributed System Security Symposium (NDSS), 2011.

Grants

Amtoft

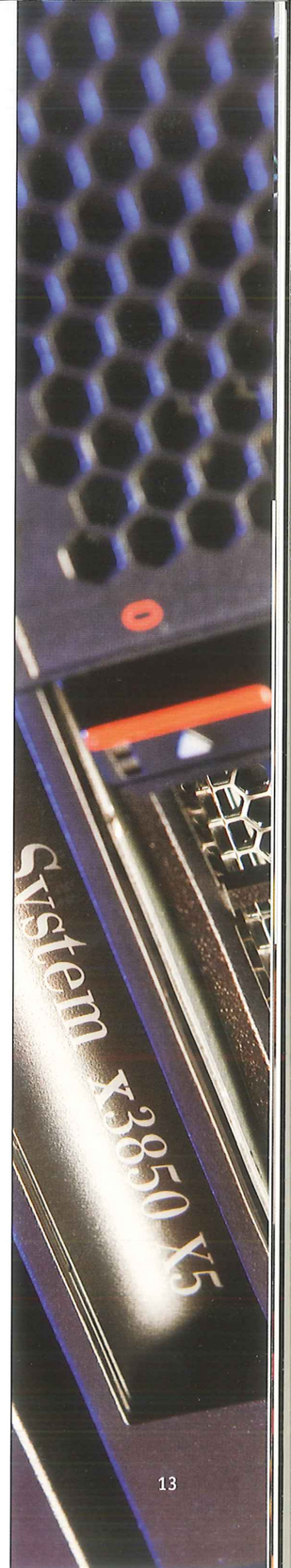
- Co-PI (with PI John Hatcliff, co-PIs Xinming Ou, Robby, and Andrew Appel—Princeton), Air Force Office of Scientific Research (AFOSR), "Evidence-Based Trust in Large-Scale MLS Systems," Total Amount: $3,000,000, KSU Portion: $2,000,000, May 2009 - August 2014.

Andresen

- PI (with co-PIs Walter Doods, Brett Esry, David Steward, and Doina Caragea), National Science Foundation (NSF), "MRI: Acquisition of a Hybrid GPU Computing Cluster for High-End Applications in Science and Engineering," $700,000, September 2011 – August 2014.
- Co-PI, National Science Foundation (NSF) EPSCoR RII Track II (Award no. 0919443), "Oklahoma and Kansas: A cyberCommons for Ecological Forecasting," $3M ($1.3M to K-State, $6M between KS and OK) September 2009 – August 2012.
- Co-PI (with PI John Hatcliff, co-PIs Robby and Steve Warren), National Science Foundation (NSF) CPS (Award no. 0932289), "CPS:Medium: Collaborative Research: Infrastructure and Technology Innovations for Medical Device Coordination," NSF Collaborative Grant with the University of Pennsylvania. Total Amount: $1,500,000, KSU Portion: $839,548, September 2009 - August 2012.
- Co-PI (with PI David Steward, co-PIs Jeffrey Peterson, Billy Golden, Stephen Welch, Scott Staggenborg, Eric Bernard, Joseph Aistrup, and Laszlo Kulcsar), National Science Foundation (NSF), "Hyper-Extractive Economies and Sustainability: Policy Scenarios for Sustainable Water Use in the High Plains Aquifer," $1,499,999, September 2009 – August 2012.
- Co-PI (with PI John Hatcliff, co-PIs Patrice Chalin, Robby, Eugene Vasserman, and Steven Warren), Mass General Hospital (NIBIB (NIH) Quantum), "Development of a Prototype Healthcare Intranet for Improved Health Outcomes," $375,000, October 2010 – September 2015.

Caragea

- PI (with PI Vasant Hanoavar, ISU), National Science Foundation (NSF), "Collaborative Research: Learning Classiers from Autonomous, Semantically Heterogeneous, Distributed Data," $145,504, July 2007 – June 2011.
- Co-PI (with co-PIs Eduard Akhunov, Bikram Gill, Frank White, Karen Garrett, James Nelson, Susan Brown, Loretta Johnson, Michael Herman, Jianming Yu, Sanjeev Narayanan, and Ludek Zurek), KSU Targeted Excellence Program "Advanced Genomics at K-State: Ultra-High Throughput DNA Sequencing," $850,000, 2008 - 2011.
- Co-PI (with PI Daniel Andresen, co-PIs Walter Dodds, Brett Esry, and David Steward), National Science Foundation (NSF), "MRI: Acquisition of a Hybrid GPU Computing Cluster for High-End Applications in Science and Engineering," $700,000, September 2011 – August 2014.
- Co-PI (with PI Steve Welch, co-PI Sanjoy Dos), National Science Foundation (NSF), "Cyberinfrastructure Implementation for Genotype to Phenotype Research," $314,847, October 2009 - March 2012.
- Co-PI (with PI Susan Brown, co-PIs Richard Beeman, Yoonseong Park, and Subbarantnam Muthukrishnan), Seed Grant ACG, KSU, "Comparative Genomics of Our Beetles in the Genus Tri-bolium," $120,000, 2010 - 2012.
- Co-PI (with PI Tony Grace, co-PIs Susan Brown, Samantha Wisely, and Anthony Joern), Seed Grant, IGF, KSU, "Comparative Transcriptome Sequence Analysis of Two Host Races of the Grasshopper Hesperotettix Viridis—Searching for Evidence of Host-Associated Divergence and Incipient Speciation," $10,000, 2010 - 2011.
- Senior Personnel (with PI Walter Dodds et al.), National Science Foundation (NSF), EPSCoR TRACK II Oklahoma and Kansas, "Wiring the Central Plains: Cyberinfrastructure to Monitor and Model Ecosystems under Directional Change," $1,605,472, 2009-2012.
- Senior Personnel (with PI Cynthia Weinig, Co-PIs Steve Welch, Justin Maloof, and Sanjoy Das), National Science Foundation (NSF), DBI – Plant Genome Research Project, TRMS: Ecological Annotation of Gene Function and Computational Analysis of Gene Networks. KSU award amount: $1,212,620, CIS SRO: 7%, 2010 - 2015.



GRANTS

Grants

Chalin

- Co-PI (with PI John Hatcliff, co-PIs Dan Andresen, Patrice Chalin, Robby, Eugene Vasserman, and Steven Warren), Mass General Hospital (NIBIB (NIH) Quantum), "Development of a Prototype Healthcare Intranet for Improved Health Outcomes," $375,000, October 2010 - September 2015.
- PI, National Science and Engineering Research Council (NSERC) of Canada, Discovery Grant, "Practical Advances in the Formal Verification of Security and Safety-Critical Software," $115,000, 2008-2013.
- Co-PI, "Cellulosic Biofuel Research Network, Agriculture and Agri-Food Canada," $1.2M, 2008-2011.

DeLoach

- PI, (with co-PI J. Adams), Air Force Office of Scientific Research (AFOSR/NM), "Human⊠Robot Teams Informed by Human Performance Moderator Functions," $604,480, June 2009 - May 2012.
- Co-PI (with PI Gurdip Singh, co-PIs Douglas McGregor and Jim Edgar), Targeted Excellence Program, KSU, "Center for Sensors and Sensor Systems," $1,500,000, July 2006 - June 2012.
- Co-PI (with PI Anil Pahwa; co-PIs Sanjoy Das, Balasubramaniam Natarajan, and Xinming Ou; Senior Personnel Gurdip Singh), National Science Foundation (NSF), "Components, Run-Time Substrates, and Systems: Medium: Holonic Multi-Agent Control of Intelligent Power Distribution Systems," $1,100,000, September 2011 - August 2015.

Gustafson

- PI (with co-PIs Xinming Ou, Gurdip Singh, and Eugene Vasserman), National Technical Systems, Inc. (NTS), "Consortium for Cyber-Security Excellence: A K-State, KBED, NTS, and CABEM Cyber-Security Partnership," $98,100, January 2011 - August 2012.

Hatcliff

- PI (with co-PIs Torben Amtoft, Xinming Ou, Robby, and Andrew Appel—Princeton University), Air Force Office of Scientific Research (AFOSR), "Evidence-Based Trust in Large-Scale MLS Systems," Total Amount: $3,000,000, KSU Portion: $2,000,000, May 2009 - August 2014.
- PI (with co-PIs Daniel Andresen, Robby, and Steve Warren), National Science Foundation (NSF) CPS (Award no. 0932289), "CPS: Medium: Collaborative Research: Infrastructure and Technology Innovations for Medical Device Coordination," NSF Collaborative Grant with the University of Pennsylvania. Total Amount: $1,500,000, KSU Portion: $839,548, September 2009 - August 2012.
- PI (with co-PIs Dan Andresen, Patrice Chalin, Robby, Eugene Vasserman, and Steven Warren), Mass General Hospital (NIBIB (NIH) Quantum), "Development of a Prototype Healthcare Intranet for Improved Health Outcomes," $375,000, October 2010 - September 2015.
- PI (with co-PIs Robby, Gurdip Singh, Virg Wallentine, and Steven Warren) NSF/FDA, "An Integrated Development and Certification Environment for a Medical Device Coordination Framework," $80,000, September 2010 - August 2011.
- Co-PI (with PI Gurdip Singh, co-PIs Balasubramaniam Natarajan, Virgil Wallentine, and Steven Warren), Cerner, "Falls Predictor Device," $93,992, May 2011 - August 2012.

Hsu

- PI, IQ Gateway LLC, "Computational Information and Knowledge Management: Data Mining, Analytics, and Information Extraction and Integration Tasks," $20,000, December 2011 - August 2012.

Neilsen

- PI (with co-PIs Gurdip Singh, J. Spears, N. Zhang, and Virgil Wallentine), National Science Foundation (NSF), "GK-12 STEM Fellowship Program: Infusing System Design and Sensor Technology in Education (INSIGHT)," $2.8M, ($564K for 2011), April 2010 - March 2015.
- PI, USDA/NRCS, "Integration of Spillway Erosion Technology and WinTR-20 with WinDAM," $150,000, August 2007 - July 2012.
- PI, Sandia National Laboratories, "Interface Development for Thermal Battery Models," $80,000, October 2010 - September 2012.
- PI, USDA/ARS, "Development of Software Tools for Predicting Embankment Erosion of Earthen Dams," $40,000, September 2007 - August 2012.
- Co-PI (with PI Gurdip Singh, co-PIs Nathan Bean, Jacqueline Spears, and Naigian Zhang), "CI-TEAM Demonstration Project: TRENDS: Training the Next-Generation Workforce in Real-Time Data and Simulation Technologies," $249,999, August 2011 - July 2013.

Ou

- PI, National Science Foundation (NSF) CAREER, "Reasoning under Uncertainty in Cybersecurity," $429,661, March 2010 - February 2015.
- PI, National Science Foundation (NSF), "TC: Small: Collaborative Research: Models and Techniques for Enterprise Network Security Metrics," $396,676, October 2010 - September 2013.
- PI (with co-PIs Gurdip Singh and Eugene Vasserman), "An Innovative Cybersecurity Curriculum for Civilian and Military Workforce," $299,652, September 2011 - August 2013.
- PI, HP Labs Innovation Research Program, "A New Approach to Rigorous Risk Analytics Using Attack Graphs," $146,000, August 2010 - July 2012.
- PI, National Science Foundation (NSF), "Research Experience for Undergraduates Supplement," $15,000, March 2010 - February 2015.
- Co-PI (with PI John Hatcliff, co-PIs Torben Amtoft, Robby, and Andrew Appel–Princeton), Air Force Office of Scientific Research (AFOSR), "Evidence-Based Trust in Large-Scale MLS Systems," Total Amount: $3,000,000, KSU Portion: $2,000,000, May 2009 - August 2014.
- Co-PI (with PI Anil Pahwa, co-PIs Sanjoy Das, Scott DeLoach, and Balasubramaniam Natarajan; Senior Personnel Gurdip Singh), National Science Foundation (NSF), "Components, Run-Time Substrates, and Systems: Medium: Holonic Multi-Agent Control of Intelligent Power Distribution Systems," $1,100,000, September 2011 - August 2015.
- Co-PI (with PI David Gustafson, co-PIs Gurdip Singh and Eugene Vasserman), National Technical Systems, Inc. (NTS), "Consortium for Cyber-Security Excellence: A K-State, KBED, NTS, and CABEM Cyber-Security Partnership," $98,100, January 2011 - August 2012.

Robby

- PI, National Science Foundation (NSF) CAREER, "CAREER: A Formal, Integrated Analysis Framework for Contract-Based Reasoning of Strong Properties of Open Systems," $400,000, April 2007 – March 2013.
- Co-PI (with PI John Hatcliff, co-PIs Torben Amtoft, Xinming Ou, and Andrew Appel–Princeton), Air Force Office of Scientific Research (AFOSR) "Evidence-Based Trust in Large-Scale MLS Systems," Total Amount: $3,000,000, KSU Portion: $2,000,000, May 2009 - August 2014.
- Co-PI (with PI John Hatcliff, co-PIs Daniel Andresen and Steven Warren), NSF Infrastructure and Technology Innovations for Medical Device Coordination. (US National Science Foundation—CNS 0932289). NSF Collaborative Grant with the University of Pennsylvania. Total Amount: $1,500,000, KSU Portion: $839,548, September 2009 - August 2012.
- Co-PI (with PI John Hatcliff, co-PIs Dan Andresen, Patrice Chalin, Eugene Vasserman, and Steven Warren), Mass General Hospital (NIBIB (NIH) Quantum), "Development of a Prototype Healthcare Intranet for Improved Health Outcomes," $375,000, October 2010 – September 2015.
- Co-PI (with PI John Hatcliff, co-PIs Gurdip Singh, Virgil Wallentine, and Steven Warren) NSF/FDA, "An Integrated Development and Certification Environment for a Medical Device Coordination Framework," $80,000, September 2010 – August 2011.

Schmidt

- PI, National Science Foundation (NSF) CNS-0939431, "Abstract Parsing: Static Analysis of Dynamically Generated String Output," $299,327, August 2009 - July 2012.

Singh

- PI (with co-PIs Douglas McGregor, Jim Edgar, and Scott A. DeLoach), Targeted Excellence Program, KSU, "Center for Sensors and Sensor Systems," $1,500,000, July 2006 - June 2012.
- PI, National Science Foundation (NSF) CSR, "Methodologies for Customization of Distributed Algorithms and Middleware," $317,000, August 2006 – July 2011.
- PI (with co-PIs Nathan Bean, Mitchell Neilsen, Jacqueline Spears, and Naigian Zhang), "CI-TEAM Demonstration Project: TRENDS: Training the Next-Generation Workforce in Real-Time Data and Simulation Technologies," $249,999, August 2011 - July 2013.
- PI (with co-PIs John Hatcliff, Balasubramaniam Natarajan, Virgil Wallentine, and Steven Warren), Cerner, "Falls Predictor Device," $93,992, May 2011 - August 2012.
- Co-PI (with PI Mitchell Neilsen, co-PIs J. Spears, N. Zhang, and Virgil Wallentine), National Science Foundation (NSF), "GK-12 STEM Fellowship Program: Infusing System Design and Sensor Technology in Education (INSIGHT)," $2.8M, ($564K for 2011), April 2010 - March 2015.
- Co-PI (with PI Xinming Ou, co-PI Eugene Vasserman), "An Innovative Cybersecurity Curriculum for Civilian and Military Workforce," $299,652, September 2011 - August 2013.
- Co-PI (with PI David Gustafson, co-PIs Xinming Ou and Eugene Vasserman), National Technical Systems, Inc. (NTS), "Consortium for Cyber-Security Excellence: A K-State, KBED, NTS, and CABEM Cyber-Security Partnership," $98,100, January 2011 - August 2012.
- Co-PI (with PI John Hatcliff, co-PIs Robby, Virgil Wallentine, and Steven Warren), NSF/FDA, "An Integrated Development and Certification Environment for a Medical Device Coordination Framework," $80,000, September 2010 - August 2011.
- Senior Personnel (with PI Anil Pahwa, co-PIs Daniel Andresen, Scott DeLoach, Sanjoy Das, Balasubramaniam Natarajan, Xinming Ou, Sanjoy Das, N. Schulz, and Daniel Andresen), "CPS: Holocnic Multiagent Control of Intelligent Power-Distribution Systems," National Science Foundation (NSF), $1,100,000, September 2011 - August 2015.
- Senior Personeel (with PI Anil Pahwa, co-PIs Sanjoy Das, Scott DeLoach, Balasubramaniam Natarajan, and Xinming Ou), National Science Foundation (NSF), "Components, Run-Time Substrates, and Systems: Medium: Holonic Multi-Agent Control of Intelligent Power Distribution Systems," $1,100,000, September 2011 - August 2015.

Vasserman

- Co-PI (with PI John Hatcliff, co-PIs Daniel Andresen, Patrice Chalin, Robby, and Steven Warren), Mass General Hospital (NIBIB (NIH) Quantum), "Development of a Prototype Healthcare Intranet for Improved Health Outcomes," $375,000, October 2010 - September 2015.
- Co-PI (with PI Xinming Ou, co-PI Gurdip Singh), "An Innovative Cybersecurity Curriculum for Civilian and Military Workforce," $299,652, September 2011 - August 2013.
- Co-PI (with PI David Gustafson, co-PIs Xinming Ou and Gurdip Singh), National Technical Systems, Inc. (NTS), "Consortium for Cyber-Security Excellence: A K-State, KBED, NTS, and CABEM Cyber-Security Partnership," $98,100, January 2011 - August 2012.

Wallentine

- Co-PI (with PI Mitch Neilsen, co-PIs Gurdip Singh, J. Spears, and N. Zhang), National Science Foundation (NSF), "GK-12 STEM Fellowship Program: Infusing System Design and Sensor Technology in Education (INSIGHT)," $2.8M, ($564K for 2011), April 2010 - March 2015.
- Co-PI (with PI Gurdip Singh, co-PIs John Hatcliff, Balasubramaniam Natarajan, and Steven Warren), Cerner, "Falls Predictor Device," $93,992, May 2011 - August 2012.
- Co-PI (with PI John Hatcliff, co-PIs Robby, Gurdip Singh, and Steven Warren), NSF/FDA, "An Integrated Development and Certification Environment for a Medical Device Coordination Framework," $80,000, September 2010 – August 2011.

PROFESSIONAL service/recognition

Amtoft
- Program committee member, 23rd Symposium on Implementation and Application of Functional Languages (IFL 2011), Lawrence, Kan., Oct. 3 – 5, 2011.
- Reviewer, Logical Methods in Computer Science, 2011.
- Reviewer, Information and Computation, 2011.
- Reviewer, Theoretical Computer Science, 2011.
- Reviewer, Information Processing Letters, 2011.
- Reviewer, ACM Computing Surveys, 2011.
- Reviewer, IEEE Transactions on Software Engineering, 2011.

Andresen
- Program committee, GPN Annual Meeting, Kansas City, Mo., June 2-4, 2011.
- Program committee, 11th IEEE International Conference on Computer and Information Technology (CIT-11) Cyprus, Aug. 31 – Sept. 2, 2011.
- International program committee member, 2011 International Conference on Grid Computing and Applications (GCA'11) Las Vegas, Nev., July 18-21, 2011.
- International program committee member, 2011 International Conference on Semantic Web and Web Services (SWWS'11) Las Vegas, Nev., July 18-21, 2011.
- International program committee member and session chair, 2010 International Conference on Parallel and Distributed Processing Techniques and Applications (PDPTA'11), Las Vegas, Nev., July 18-21, 2011.
- International program committee member, 2011 International Conference on Internet Computing (ICOMP'11), Las Vegas, Nev., July 18-21, 2011.
- GPN CI program committee (K-State representative), 2011.
- GPN strategic planning session, K-State representative, June 1, 2011.

Caragea
- Program committee member, AAAI Doctoral Consortium (DC) Program, in conjunction National Conference on Artificial Intelligence (AAAI), 2011.
- Program committee member, IEEE International Conference on Bioinformatics and Biomedicine (BIBM), 2011.
- Program committee member, First IEEE International Conference on Computational Advances in Bio and Medical Sciences (ICCABS), 2011.
- Program committee member, International Conference on Knowledge Engineering and Ontology Development (KEOD), 2011.
- Program committee member, Conference on Statistical, Computational, and Visualization Methods in Medical Informatics, 2011.
- Reviewer and panelist for NSF, CISE Directorate, IIS Division, 2011.
- Reviewer, BMC Bioinformatics, BMC Genomics, Wiley Interdisciplinary Reviews – Data Mining and Knowledge Discovery (DMKD), International Journal of AI Tools (IJAIT), 2011.

Chalin
- Co-organizer: Workshop on the System of Medical Devices, 2011.

DeLoach
- Editorial board, International Journal of Agent-Oriented Software Engineering, 2011.
- Program committee, International Conference on Autonomous Agents and Multiagent Systems (AAMAS), 2011.
- Program committee, International Conference on Agents and Artificial Intelligence (ICAART), 2011.
- Program committee, International Workshop on Agent-Oriented Software Engineering (AOSE), 2011.
- Program committee, IEEE International Multi-Disciplinary Conference on Cognitive Methods in Situation Awareness and Decision Support (CogSIMA), 2011.
- Reviewer, IEEE Transactions on Smart Grid, 2011.

Gustafson
- Writing/revising articles for the McGraw-Hill Encyclopedia of Science and Technology.
- Writing reviews for Computing Reviews.
- Serving on program committee for International Symposium on Visual Computing.

Hatcliff
- Co-chair, Workshop on Systems of Systems of Medical Devices (SoSMD), Lawrence, Kan., Nov. 2011.
- Steering committee member, International Conference on Formal Techniques for Distributed Systems, 2011.
- Program committee member, 2011 IFIP Conferences on Formal Methods for Open Object-Based Distributed Systems (FMOODS) and International Conference on FORmal TEchniques for Networked and Distributed Systems (FORTE) Reykjavik, Iceland, June 6-9, 2011.
- Program committee member, High-Confidence Medical Device Systems and Software (HCMDSS 2011), Chicago, Ill., April 11, 2011.
- Program committee member, International Conference on Software Engineering (ICSE 2011), Waikiki, Hawaii, 2011.
- Program committee member, Workshop on Software Engineering in Health Care (SEHC 2011), Waikiki, Hawaii, May 2011.

Hsu
- Program chair, International Joint Conference on Artificial Intelligence (IJCAI) Workshop on Heterogeneous Information Network Analysis (HINA), 2011.
- Editorial board, Intelligent Data Analysis, 2011.

Neilsen
- National Science Foundation (NSF) review panel, 2011.
- Session chair, PDPTA, 2011.
- Session chair, CAINE, 2011.

Ou
- Invited speaker, National Center for Configuration Analytics and Automation (NCCAA) Meeting/Workshop, University of North Carolina at Charlotte, May 2011.
- Invited speaker, 1st Experimental Security Panoramas Workshop (ESP), Aug. 2011.
- Tutorial speaker, 27th Annual Computer Security Applications Conference (ACSAC), 2011.
- Program committee member, Conference on Privacy, Security and Trust (PST), 2011.
- Program committee member, 4th Symposium on Configuration Analytics and Automation (SafeConfig), 2011.
- Program committee member, International Symposium on Resilient Control Systems (ISRCS), 2011.
- Reviewer, ACM Transactions on Information and System Security (TISSEC), 2011.
- Reviewer, ACM Conference on Computer and Communications Security (CCS), 2011.
- Reviewer, IEEE Transactions on Dependable and Secure Computing, 2011.
- Reviewer, Journal of Computer Security, 2011.
- Reviewer, Future Internet, 2011.

Robby
- Workshop co-chair, 26th IEEE/ACM International Conference on Automated Software Engineering (ASE), 2011.
- Program committee member, 13th International Workshop on Verification of Infinite-State Systems (INFINITY), 2011.
- Reviewer, International Journal on Software and System Modeling (SoSyM), 2011.

Schmidt
- Steering committee, Static Analysis Symposia and Conferences on Verification, Model Checking, and Abstract Interpretation, 2011.
- Advisory board, Journal of Higher-Order and Symbolic Computation, 2011.
- Program committee, Conference on Verification, Abstract Interpretation, and Model Checking (co-chair) and International Andrei Ershov Memorial Conference: Perspectives of System Informatics, 2011.

Singh
- Reviewer, Journal of Parallel and Distributed Computing, 2011.
- Advisory Board, Computer Science Department, Mississippi State University, 2011.

Vasserman
- Reviewer, Transactions on Information and System Security (TISSEC), 2011.
- Reviewer, Network and Distributed System Security Symposium (NDSS), 2011.
- Reviewer, Workshop on Privacy in the Electronic Society (WPES), 2011.
- Reviewer, International Conference on Distributed Computing Systems (ICDCS), 2011.
- Reviewer, IEEE Internet Computing magazine, 2011.
- Reviewer, Privacy Enhancing Technologies Symposium (PETS), 2011.
- Reviewer, IEEE International Conference on Computer and Communications Technology (ICCCT), 2011.
- Reviewer, ACM Conference on Computer and Communications Security (CCS), 2011.

Undergraduate Studies

Undergraduate

The CIS department offers two B.S. degrees: one in information systems (IS) and one in computer science (CS). The CS degree program now has two options:

- a traditional computer science track, which focuses on foundational and scientific issues, including courses on operating systems and databases; and
- a software engineering track, which focuses on software development, including enterprise information systems, project management, software security, parallel programming and software development in a team environment.

Both degree programs allow students flexibility in their programs of study. Students are encouraged to pursue a minor or to study interdisciplinary subjects while still completing their degrees within four years.

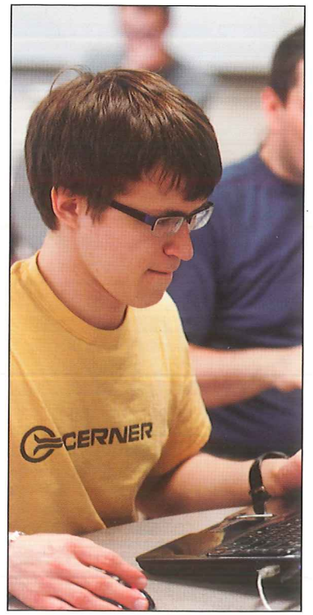
Computer science requirements for each of the three options have a core consisting of 16 credit hours and an option-specific set of 17 hours of advanced courses. The 16 credit-hour core also serves as the minor in computer science.

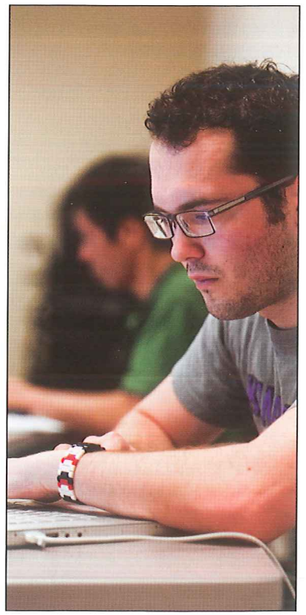
ACM Student Chapter

The local ACM chapter is a professional organization for CIS majors. Average attendance at monthly meetings is 30-40 students. Typically more than a dozen attend the ACM regional programming contest for a chance to interact with their peers and develop professional skills.

AAAI Robotics Competition

The joint undergraduate and graduate robotics team prepares to participate in robotics events at the annual convention of the Association for the Advancement of Artificial Intelligence. The team has competed each of the last five years in this event, a popular project for both undergraduate and graduate students.





Graduate Studies

Graduate

The department of computing and information sciences is committed to excellence in scholarly activities in research and graduate teaching. We offer courses and a rich variety of projects in the areas of programming languages, high-assurance software, distributed computing, networking, software engineering, bio-informatics, computer security and data mining. In addition to basic research, our curriculum emphasizes collaborative and interdisciplinary research, collaboration with industrial partners, and development and distribution of software tools. We offer two master-level degrees, the master of science (M.S.) and master of software engineering (M.S.E.), and the doctor of philosophy degree in computer science. We offer the M.S.E. degree via distance learning, and a graduate certificate program in real-time embedded systems in collaboration with other engineering departments.

Admission requirements

Applicants for our graduate degrees must possess a bachelor's degree, with at least a 3.0 grade point average or equivalent, from an accredited institution. Students not possessing a degree in computer science must have background that includes the equivalent of core undergraduate computer science courses.

Areas of concentration

Programming language, high-assurance software, distributed computing, networking, software engineering, bio-informatics, computer security and data-mining, high-performance computing.

Certificate program

Graduate certificate in real-time embedded systems.

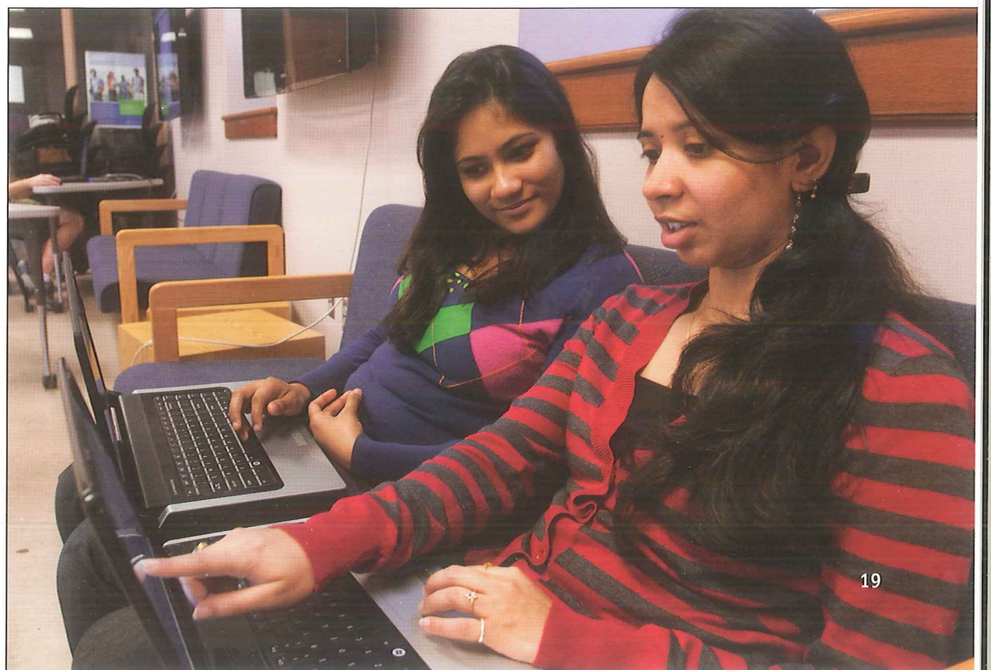
Resources for current and prospective graduate students

- CIS admissions: *http://cis.ksu.edu/programs/grad/admissions*
- CIS research projects: *http://cis.ksu.edu/research*
- CIS profile on Peterson's Online guide: *http://graduate-schools.petersons.com*

How to apply

For a graduate applicaion and other information, contact:

Graduate Studies
Department of Computing and Information Sciences
234 Nichols Hall
Kansas State University
Manhattan, KS 66506 USA
Phone:785-532-6350; Fax: 785-532-7353;
email: cis-gradapps@ksu.edu



Advisory Board

The CIS advisory board is composed of leaders in the development and deployment of software in industry. Because software is pervasive throughout our society, these advisers are technical, management and executive leaders in a broad spectrum of industrial sectors—software development, e-commerce, health IT, transportation, manufacturing, retail, communications, wealth management, military and academe. This industrial leadership helps us in three ways:

- Through industrial and university affiliations, it connects us to our alumni, practicing professionals, industry leaders, government leaders and academic researchers. These connections enable us to build collaborative relationships between academia and industry.
- It provides advice on the "state of the practice" in the software industry. This perspective helps us better prepare students for the software development profession, and better integrate our research results into real products and industrial processes.
- Advisory board members provide financial support from both personal and industry sources.

Katherine (Kacy) Clark
Principal Consultant / Architect
Cloud Technology Partners

Terry Ecklund
Private IT Consultant

Lynn Frick
Database Administrator
Kansas State University Foundation

Dominic Gelinas
Software Engineer
L-3 Communications

Dr. Mary Lou Hines
CIO, Vice Provost
UMKC (Board Chair)

Martin Malley
Assistant Vice President
Union Pacific Railroad

Don Mounday
President / Co-Founder
Falcon Technology Group, LLC

Mark Schonhoff
Vice President
Cerner Corp.

Ken Switzer
President / Founder, Retired
Pegasus Programming Solutions

Dr. Ray Vaughn
Associate Vice President for Research /
William L. Giles Distinguished Professor
Mississippi State University

Emeritus Members

Jerry Havemann
Vice President, Retired
Cargill

Jacqualine Trombly
Operations Director, Retired
Lucent Inc.

Dennis Yeo
Founder
Multigen/Paradigm

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Vasserman, Eugene	Assistant Professor	(785) 532-7944	Nichols 316A	eyv@ksu.edu
Wallentine, Virgil	Professor	(785) 532-7365	Nichols 316C	virg@ksu.edu

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Computing and Information Sciences

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